Soleduck River watershed –

The Soleduck River watershed includes over 35 percent of the Quillayute River watershed, covering approximately 225.4 square-miles in drainage area. The confluence of the Soleduck River and the Bogachiel River marks the beginning of the Quillayute River, which is only about 6.5 miles upstream for the coast. The location of the Soleduck River watershed is presented in Figure 17 below.

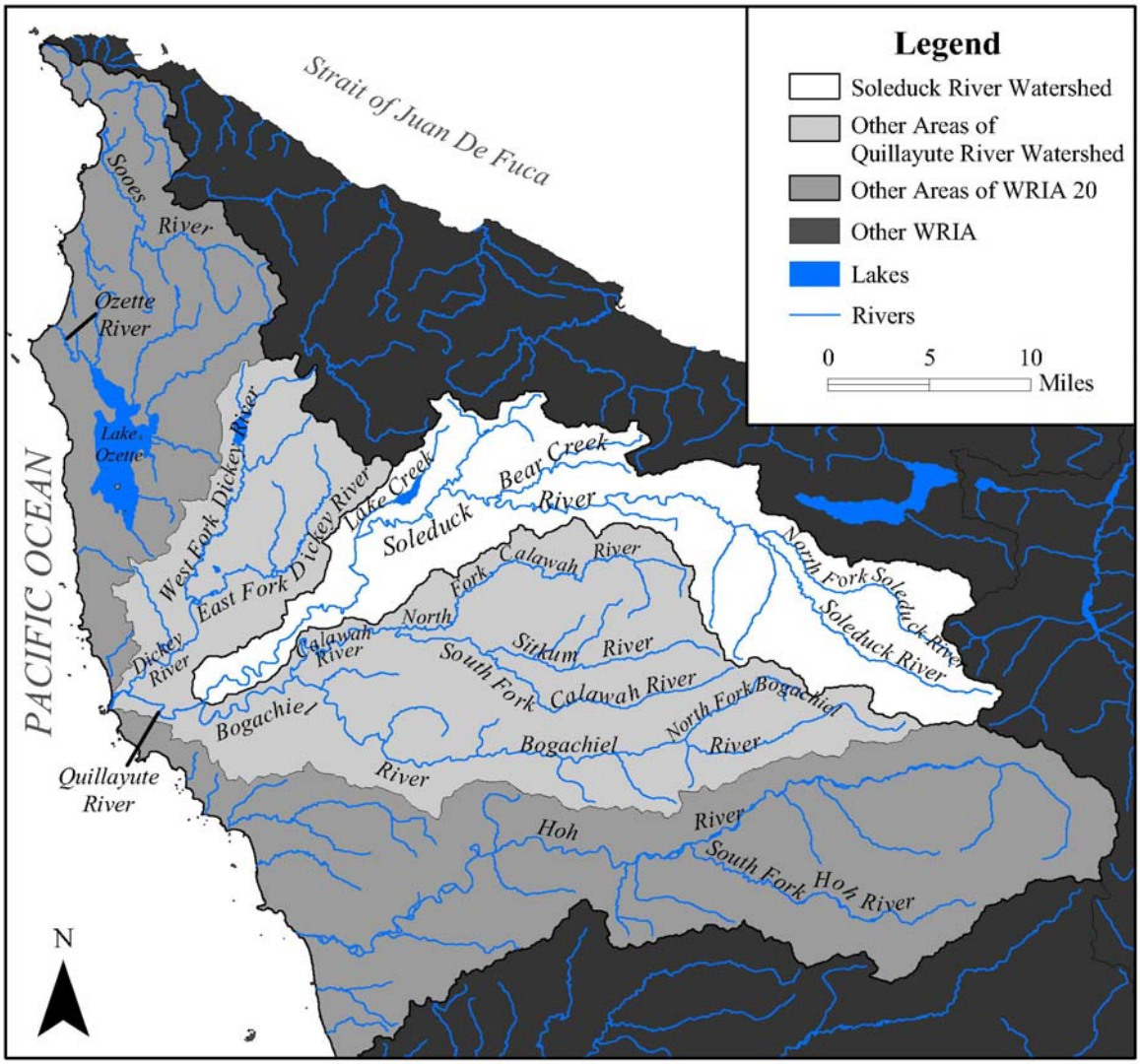

Figure 17. Location of Soleduck River watershed within WRIA 20.

The Soleduck River basin defines the eastern edge of WRIA 20 and is bound by the Dickey River watershed to the northwest and the Calawah and Bogachiel River basins to the south. The Pysht and Twin River basins of WRIA 19 are located to the north, along with the Lake Crescent basin also within WRIA 19.

The Elwah River basin, which is part of WRIA 18, is located to the east of the headwaters.

Elevation of the Soleduck River watershed ranges from about 25 feet above sea level at the outlet to over 6000 ft at the headwaters. Average annual precipitation is highest along the southern headwater edge, reaching over 122 inches per year near Deer Lake, and decreases to the north and west with the lowest values of less than 90 inches per year near the outlet. The Soleduck River headwaters are defined by the High Divide along the south and Happy Lake Ridge along the north. Several peaks define the eastern basin edge, including Bogachiel Peak, Mount Appleton, Everett Peak, Boulder Peak, and Lizard Head Peak. The southern Soleduck headwaters cover the Seven Lakes Basin within the Olympic National Park and continue northwest. The entire North Fork Soleduck River basin lies within the national park boundary as well. Table 31 below lists the Soleduck drainage areas by land management.

Table 31. Land administration within the Soleduck River watershed.

Land Administration	Area (sq. mi.)	Percent of Total Area
Olympic National Park	72.6	32.2
Late-successional Reserves (USFS)	40.6	18.0
Adaptive Management (USFS)	31.0	13.8
State of Washington	30.3	13.4
Privately owned	50.9	22.6
Total Area	225.4	100

The largest portion of the watershed lies within the Olympic National Park, but almost an additional 18 percent has been designated Late-successional reserve in the President's Northwest Forest Plan of 1994. The land management activities in practice today likely relate to these administration areas, where the majority of timber removal occurs within state and privately owned lands, as well as within the Adaptive Management areas of the Olympic National Forest.

For demonstration purposes, the Soleduck has been separated into upper and lower areas. The administrative areas for the upper Soleduck are illustrated in Figure 18, and the lower Soleduck is illustrated in Figure 19. All Soleduck River basin lands within the Olympic National Park are included in the upper Soleduck area. The tributaries of the upper Soleduck include the North Fork and South Fork Soleduck River, which combine with the Soleduck River just upstream of the USGS gaging station on the Soleduck River near Fairholm (#12041500). The next downstream USGS gaging station, located upstream of Kugel Creek near the USDA Forest Service Snider Ranger Station, was named the Soleduck River near Beaver (#12042000). The location of this gage is illustrated on both the upper and lower Soleduck maps to illustrate map overlap, but is no longer in service.

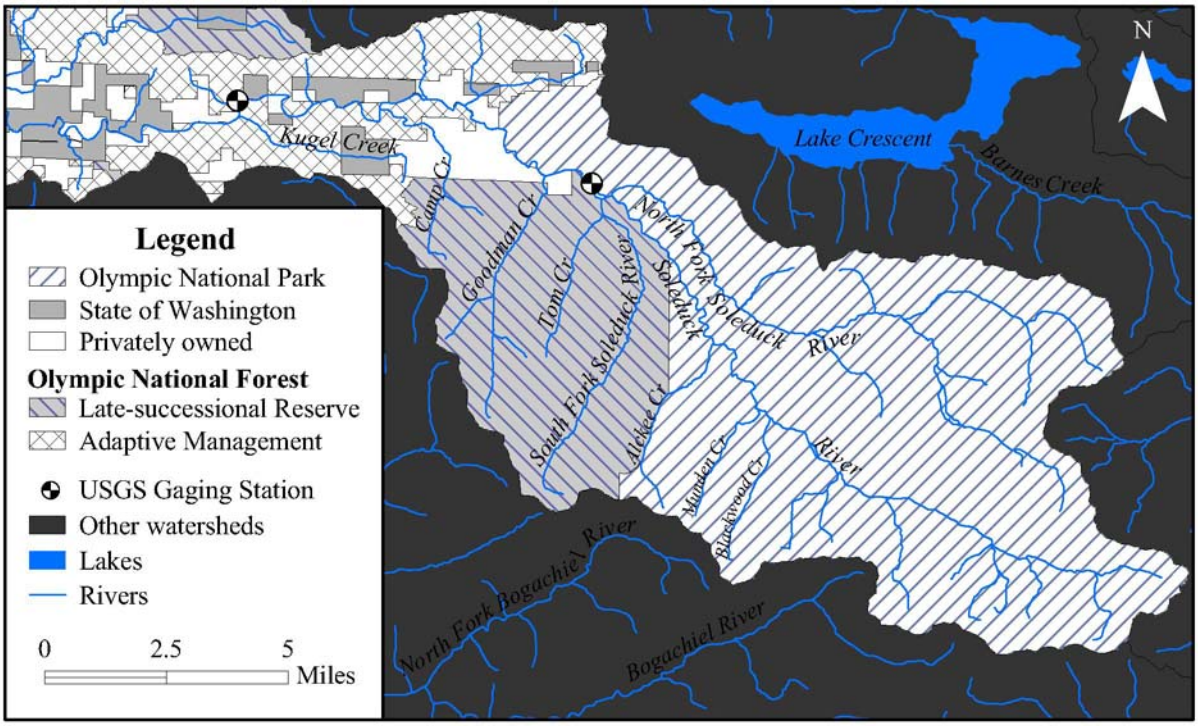

Figure 18. Land Administration within the upper Soleduck River watershed.

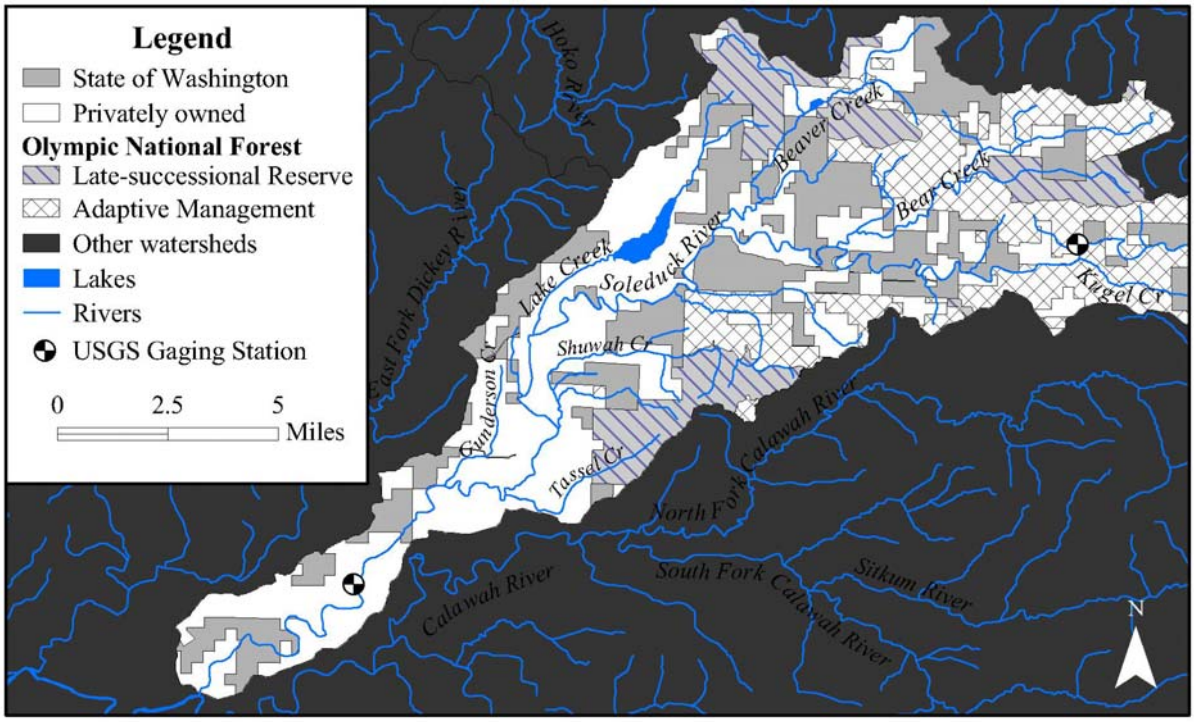

Figure 19. Land Administration within the lower Soleduck River watershed.

The lower Soleduck River watershed is dominated by state and privately owned lands, yet still includes a fair amount of Forest Service lands which are typically located at higher elevations. Several more tributaries outflow into the Soleduck River below USGS gaging station 1242000, including Bear Creek, Beaver Creek, Lake Creek, Shuwah Creek, Tassel Creek and Gunderson Creek. The most downstream USGS gaging station illustrated was located downstream of all these tributaries and is named the Soleduck River near Quillayute (#12042500). This gage was located at the bridge where Quillayute Road crosses the Soleduck River, but is no longer in service.

Relative age classes of timber on Forest Service lands within the Soleduck River basin were inventoried by the USDA Forest Service, and the resultant GIS coverage provided the information provided in Table 32 (ONF, 2000). This timber age class analysis did not characterize lands within the Olympic National Park, yet old-growth conditions likely exist within the park.

Table 32. Age class descriptions of part of the timber located within the Soleduck River watershed.

Age Class Designated by USDA Forest Service	Area (sq. mi.)	Percent of Total Area
0 - 20 years	6.74	7.2
21 - 40 years	10.9	11.6
41 - 60 years	17.8	18.9
61 - 80 years	18.3	19.5
81 - 160 years	12.7	13.5
over 160 years	27.6	29.3
Total Area	94.2	100

The upper Soleduck River basin is split between highland and upland subwatershed areas. The highest elevation areas are characterized as Highland subwatershed types, as defined by the watershed characteristics method. These areas generally start near 1700 ft in elevation and extend to over 6000 ft. Figure 20 below illustrates the subwatershed types of the entire Soleduck River watershed. Upland areas generally begin near 600 ft above sea level and extend to less than 3200 ft. While the highland areas are characterized by snowmelt accumulation that continues to melt and provide streamflow into the late summer, the upland areas are either located below the average snow line or the snow usually melts within a short period of time. Upland areas contribute large portions of streamflow during winter precipitation months. The most downstream highland area is found along the southern slope of Mount Mueller, and the transition from upland to lowland subwatershed areas is another few miles downstream. This transition is also captured on the watershed characteristics map, Figure 20, below.

The summary of watershed characteristics above the gage was necessary to complete any work on the Soleduck River.

The transition between lowland and upland areas within the Soleduck River is located downstream of Kugel and Snider Creeks, as well as below the USDA Forest Service Snider Ranger Station. Lowland areas begin near 200 ft above sea level and extend only to 1300 ft, as described by the watershed characteristics method. These areas provide additional streamflow during the winter precipitation months with similar precipitation patterns as the upland areas. Precipitation that falls within lowland subwatersheds are more likely to be lost to subsurface water levels, especially within valley bottoms. When valley floors are expansive and flat, a larger portion of precipitation is lost to ground water and not reflected in surface water gaging, thus these areas are considered ineffective towards surface water streamflow.

A large coastal lowland subwatershed is found in the most downstream portion of the Soleduck River watershed. Coastal lowland areas begin at sea level and extend only up to 400 ft in elevation. These areas function very similar to lowland areas, but are located at lower elevations. Also, the amount of additional precipitation that is captured in flat coastal lowland areas is nearly equivalent to the amount of water lost to ground water, evaporation, and interception. Therefore, some coastal lowland areas were considered ineffective to surface water flows in the Soleduck River. Table 33 below summarizes the area of the Soleduck River watershed covered within each subwatershed type.

Table 33. Watershed characteristics of areas within the Soleduck River watershed.

Watershed Characteristics	Area (sq. mi.)	Percent of Total Area
Highland	76.5	33.9
Upland	87.6	38.8
Lowland	34.0	15.1
Lowland, *but ineffective*	17.7	7.9
Coastal Lowland	5.09	2.3
Coastal Lowland, *but ineffective*	3.78	1.7
Lake Pleasant	0.77	0.3
Total Area	225.4	100

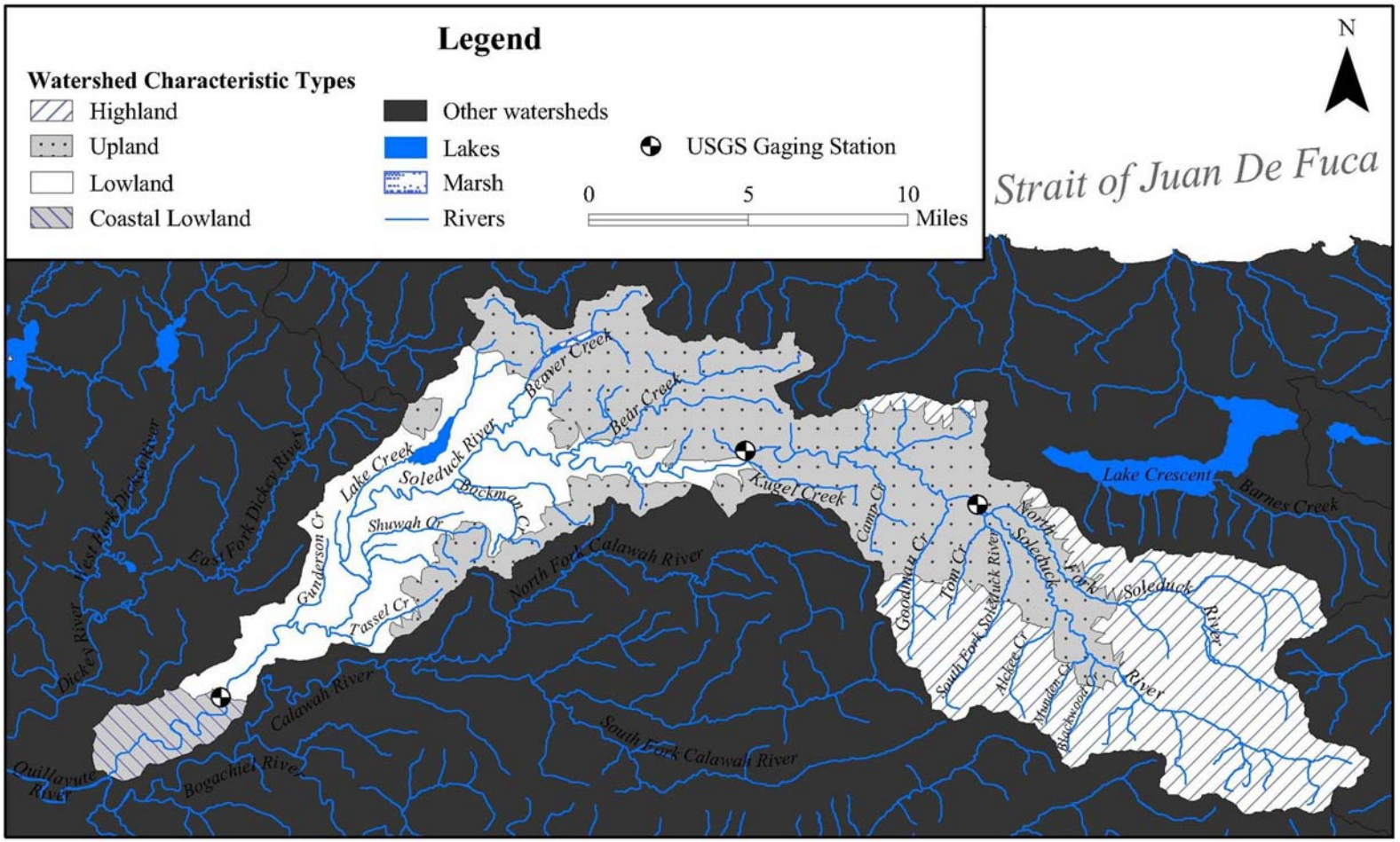

Figure 20. Watershed Characteristics of the Soleduck River watershed.

Another more specific watershed characteristic type is subsumed within the highland area called the alpine subwatershed. The alpine subwatershed functions similarly to the highland watershed, but differs slightly. Alpine subwatersheds are usually above the tree line, and therefore do not experience interception losses related to the forest cover of highland areas. Also, snow accumulated in some alpine areas does not melt entirely each year, creating small or sometimes large glaciers. Often these alpine areas are located on north facing slopes, which receive less direct sunlight and experiences slower snowmelt. The alpine area within the Soleduck River watershed is located at the highest elevations of the main stem and North Fork Soleduck River basins, particularly in the Seven Lakes Basin and along the north and south flanks of Mount Appleton. The alpine area continues north to the western slope of Boulder Peak. Since alpine subwatershed areas are not considered to function in a significantly different manner from the highland areas, they were not separated out from highland areas in Table 33 or Figure 20.

Streamflow Evaluations of the Soleduck River

Streamflow histories were determined at several locations within the Soleduck River watershed. A complete period of record was necessary for each pertinent location to evaluate streamflow at these locations. These streamflow histories needed to represent natural or unimpaired conditions to benefit the WRIA 20 management group. To estimate streamflow at multiple locations in the Soleduck River watershed, streamflow information was compiled from three USGS gaging station records within the Soleduck River. From upstream to downstream, these three gages are:

- USGS Station Number 12041500 Soleduck River near Fairholm, WA
- USGS Station Number 12042000 Soleduck River near Beaver, WA
- USGS Station Number 12042000 Soleduck River near Quillayute, WA

Streamflow measurements were collected at the most upstream gage near Fairholm between October 1933 and October 1971 as well as between November 1975 and September 1980. Of the gaged data available, the Fairholm gage has the longest period of record during the relevant flow history of October 1961 and September 1999. In order to use this gage to estimate natural streamflow in the remaining Soleduck River watershed, the gaged streamflow measurements needed to be unaffected by diversions or upstream timber removal. The USGS indicated in their gage summary each year that no diversions occur upstream of this gage, so the upstream contributing area was investigated for land management activities that may affect streamflow at the gage location.

The contributing area above the Fairholm gage is administered either by the USDA forest Service or by the National Park Service within the Olympic

National Park. Forest Service lands on the Olympic Peninsula were inventoried for relative timber age classes by the USDA Forest Service and provided a resultant GIS coverage of timber age classes. This timber age class analysis did not characterize lands within the Olympic National Park, yet old-growth conditions likely exist within the park. If we assume that old-growth conditions exist on the 68.7 square-miles of park land above USGS gaging station 12041500, Soleduck River near Fairholm, WA, then we can accurately describe all of the land above this gage. If we assume that the timber in these park lands are older than 160 years old, then Table 34 would represent the breakdown of all timber age classes above the Soleduck near Fairholm gage. Since less than 10 percent of the contributing area include stands of timber that average younger than 60 years, we assumed the streamflow information gathered at the Fairholm gage represent natural or unimpaired conditions. Consequently, this gage provided the majority of Soleduck River streamflow information used to estimate complete periods of record for other gaged and ungaged locations in the Soleduck River.

Table 34. Estimated* age class descriptions of the timber on all lands upstream of USGS gaging station 12041500, Soleduck River near Fairholm (ONF, 2000).

Age Class Designated by USDA Forest Service	Area (sq. mi.)	Percent of Total Area
0 - 20 years	1.56	1.9
21 - 40 years	3.4	4.0
41 - 60 years	3.1	3.7
61 - 80 years	0.00	0.0
81 - 160 years	0.10	0.1
over 160 years*	75.7	90.3
Total Area	83.8	100

* Contributing area within the Olympic National Park (68.7 square-miles) was assumed to be older than 160 years old.

Regression techniques were used to extend USGS gaging station 12041500 based on the nearby USGS gaging stations Quinault River at Quinault Lake (#12039500), which has a period of record starting in 1911 and is still in operation today. These regressions were completed on a monthly-basis and exhibited highly similar relationships with the lowest R^2 value of 0.82 occurring in the month of May and six other monthly R^2 values over 0.90.

The extended synthetic streamflow history for the Fairholm gage was used to create streamflow histories at all the remaining Soleduck River locations based on the watershed characteristics method. Available streamflow measurements at the remaining gaged and ungaged locations were used to calibrate estimates generated through the watershed characteristics method. The watershed characteristics method relies on a nearby streamflow gage to estimate relative streamflow contributions from each type watershed, e.g. highland, upland,

lowland, etc. For the Soleduck River, the watershed characteristics method was applied against USGS gaging station 12042800, the Bogachiel River near Forks, to estimate type watershed streamflow histories.

The locations where natural streamflow histories were developed in the upper Soleduck River are illustrated in Figure 21, and the remaining locations in the lower Soleduck River watershed are illustrated in Figure 22. Gage markers indicate locations were USGS gaged information was available, where as ungaged locations were streamflow was evaluated are designated by a black triangle. The contributing watershed of each flow evaluation site is also indicated by the thick black line encompassing the white subwatershed. The watershed characteristics of each contributing area are summarized by area in Table 35 and the corresponding average annual precipitation of these areas are summarized in Table 36. Keep in mind, each additional portion of the Soleduck River watershed discussed in Table 35 and Table 36 represent the remaining additional area before the next downstream location. To accurately characterize the watershed characteristics that contribute to each location on the Soleduck River, the preceding columns to the left of the indicated location need to be summed.

The estimated range of natural streamflow at each pertinent location is described below. These discussions include a description of how the streamflow information was estimated, which may indicate that instantaneous streamflow information was available to calibrate streamflow estimates. To clearly illustrate the range of streamflow expected at each location, a graphical illustration of monthly average streamflow in cfs is included, as well as a table summarizing the expected range is streamflow in each month. The percentiles indicated in both the graphs and the tables represent the amount of time when average monthly streamflow is expected to be equal to or exceed the indicated value in cfs. A complete period of record was estimated for each site, and these records can be found in Appendix 3.

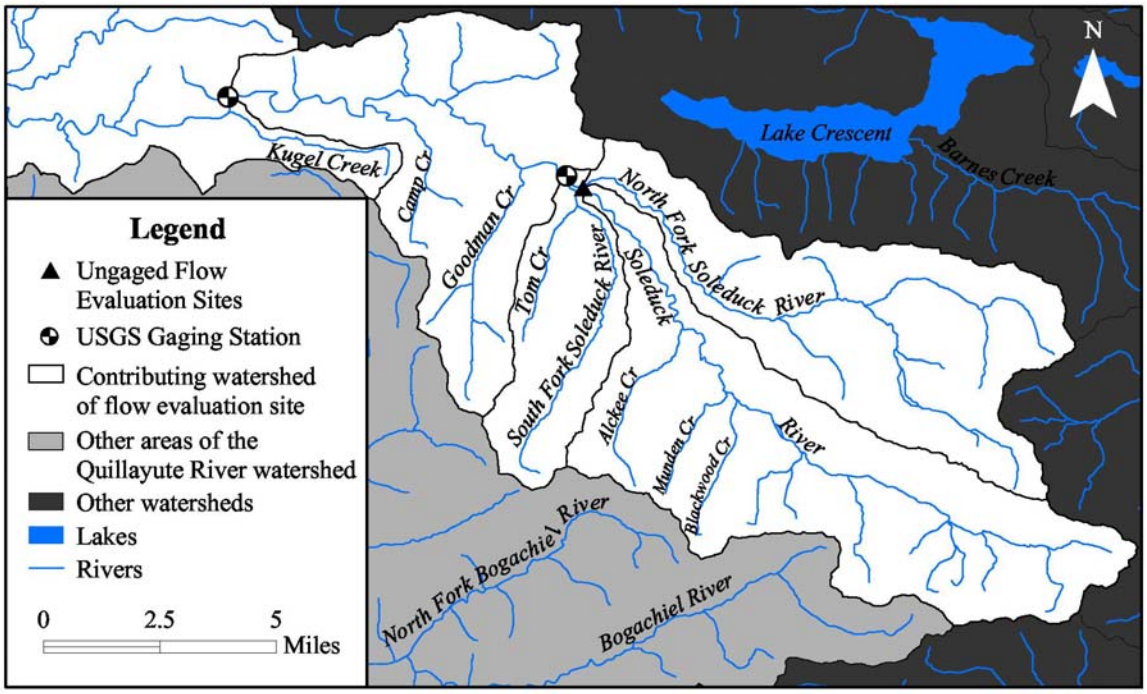

Figure 21. Locations within the upper Soleduck River watershed where natural flows were developed.

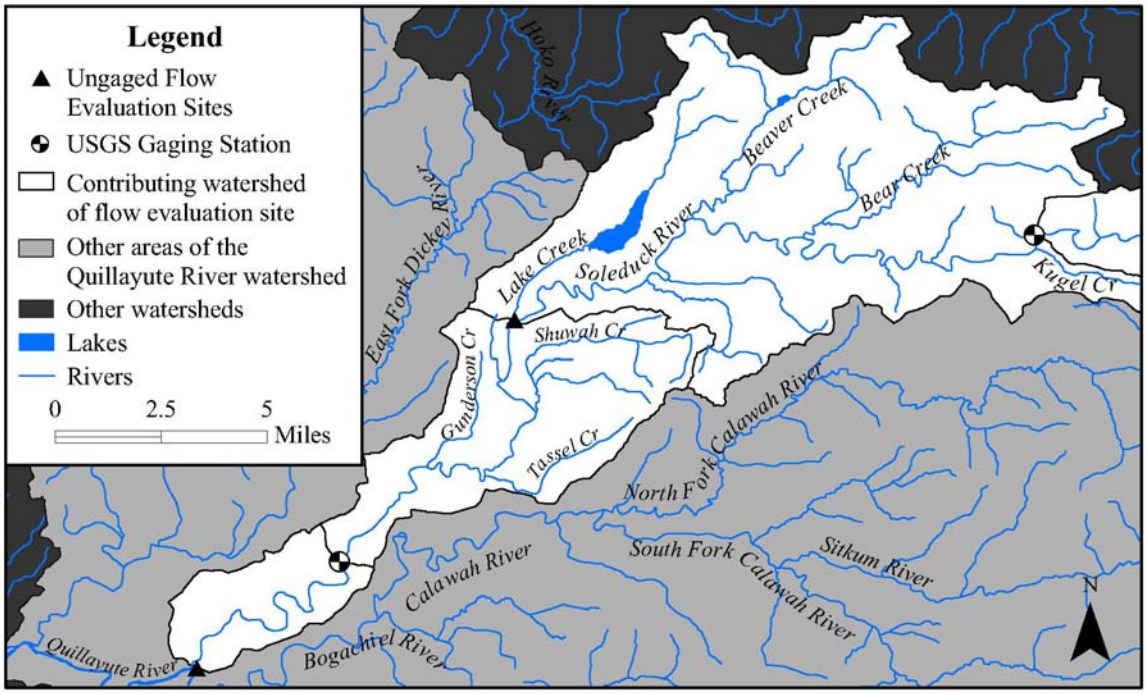

Figure 22. Locations within the lower Soleduck River watershed where natural flows were developed.

Table 35. Watershed characteristics within each portion within the Soleduck River watershed.

Watershed Characteristic Types	North Fork Soleduck River at Outlet	Soleduck River above North Fork Soleduck River confluence	Soleduck River at gage # 12041500 - Soleduck River nr Fairholm	Soleduck River at gage # 12042000 - Soleduck River nr Beaver	Soleduck River below Lake Creek	Soleduck River at gage # 12042500 - Soleduck River nr Quillayute	Soleduck River at Outlet
	Area (sq. mi.)	Area (sq. mi.)	Area (sq. mi.)	Area (sq. mi.)	Area (sq. mi.)	Area (sq. mi.)	Area (sq. mi.)
Highland	26.8	35.5	7.97	6.27	-	-	-
Upland	3.91	5.18	4.44	25.1	44.7	4.33	-
Lowland	-	-	-	-	20.0	13.9	-
Lake Pleasant	-	-	-	-	0.77	-	-
Lowland-*ineffective*	-	-	-	-	9.91	7.82	-
Coastal Lowland	-	-	-	-	-	-	5.09
Coastal Lowland-*ineffective*	-	-	-	-	-	-	3.78
Entire area	30.7	40.6	12.4	31.3	75.4	26.1	8.87

Table 36. Average annual precipitation of each portion within the Soleduck River watershed.

Watershed Characteristic Types	North Fork Soleduck River at Outlet	Soleduck River above North Fork Soleduck River confluence	Soleduck River at gage # 12041500 - Soleduck River nr Fairholm	Soleduck River at gage # 12042000 - Soleduck River nr Beaver	Soleduck River below Lake Creek	Soleduck River at gage # 12042500 - Soleduck River nr Quillayute	Soleduck River at Outlet
	Ave Ann Precip (in)	Ave Ann Precip (in)	Ave Ann Precip (in)	Ave Ann Precip (in)	Ave Ann Precip (in)	Ave Ann Precip (in)	Ave Ann Precip (in)
Highland	89.8	103.4	111.0	104.8	-	-	-
Upland	94.2	94.6	98.4	98.9	100.5	122.2	-
Lowland	-	-	-	-	116.0	111.9	-
Lake Pleasant	-	-	-	-	122.6	-	-
Lowland-*ineffective*	-	-	-	-	116.3	109.0	-
Coastal Lowland	-	-	-	-	-	-	93.2
Coastal Lowland-*ineffective*	-	-	-	-	-	-	88.8
Entire area	90.4	102.3	106.5	100.1	106.9	112.8	91.3

North Fork Soleduck River at the Outlet –

The North Fork Soleduck River outlets into the Soleduck River at RM 55.2, about 0.7 mile upstream of USGS gage 12041500. Precipitation in the contributing watershed varies between about 80 inches annually near Boulder Peak to over 102 inches at Aurora Peak. Streamflow for this location was estimated by separating out streamflow from the North Fork Soleduck River from that generated in the remaining areas of Soleduck River upstream of the gage using the watershed characteristics method.

The North Fork Soleduck River is dominated by highland subwatershed, which explains the bi-modal distribution of the hydrograph illustrated below. Winter precipitation creates the largest increase in streamflow, and an additional increase is attributable to snowmelt runoff in the spring month of May. The greatest variation in streamflow is exhibited between November and February, and baseflow conditions begin in August and can extend into October.

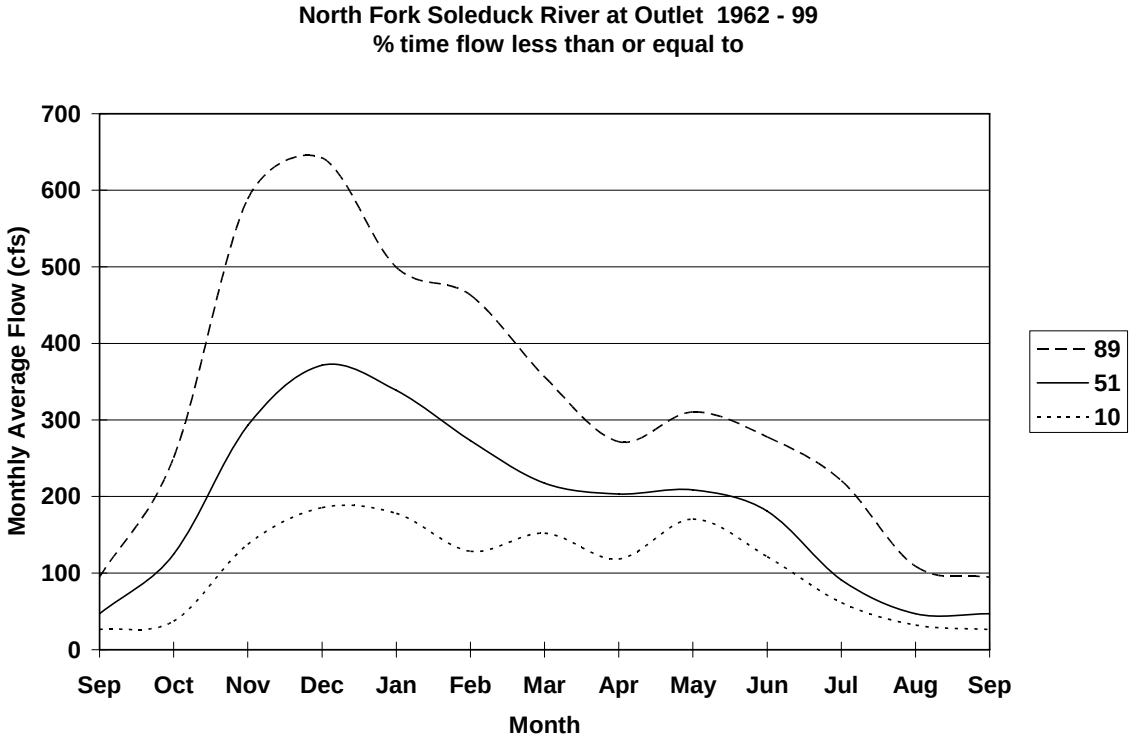

Table 37. The percent of time that average monthly streamflow (cfs) at the outlet of the North Fork Soleduck River is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	250	589	642	499	463	356	272	311	278	221	109	95
51	125	293	372	339	273	217	203	209	181	91	47	47
10	37	138	185	178	128	152	118	170	121	61	32	26

Soleduck River above North Fork Soleduck River -

The Soleduck River above the North Fork Soleduck River contains several tributaries, including Blackwood Creek, Munden Creek, and Alckee Creek. Average annual precipitation is highest along the southern edge, where averages exceed 130 inches annually, and decreases to the north, averaging about 83 inches annually along the ridge separating the Soleduck and North Fork Soleduck River watersheds. Streamflow information was developed for this location using the watershed characteristics method against the USGS gage 12041500.

The months with the greatest variation in streamflow are November through January, as also seen in the North Fork Soleduck River. Baseflow levels can extend into October, but more often ends in September. Streamflow in the main stem Soleduck River also exhibits a bi-modal distribution, since the contributing area is dominantly characterized as highland subwatershed.

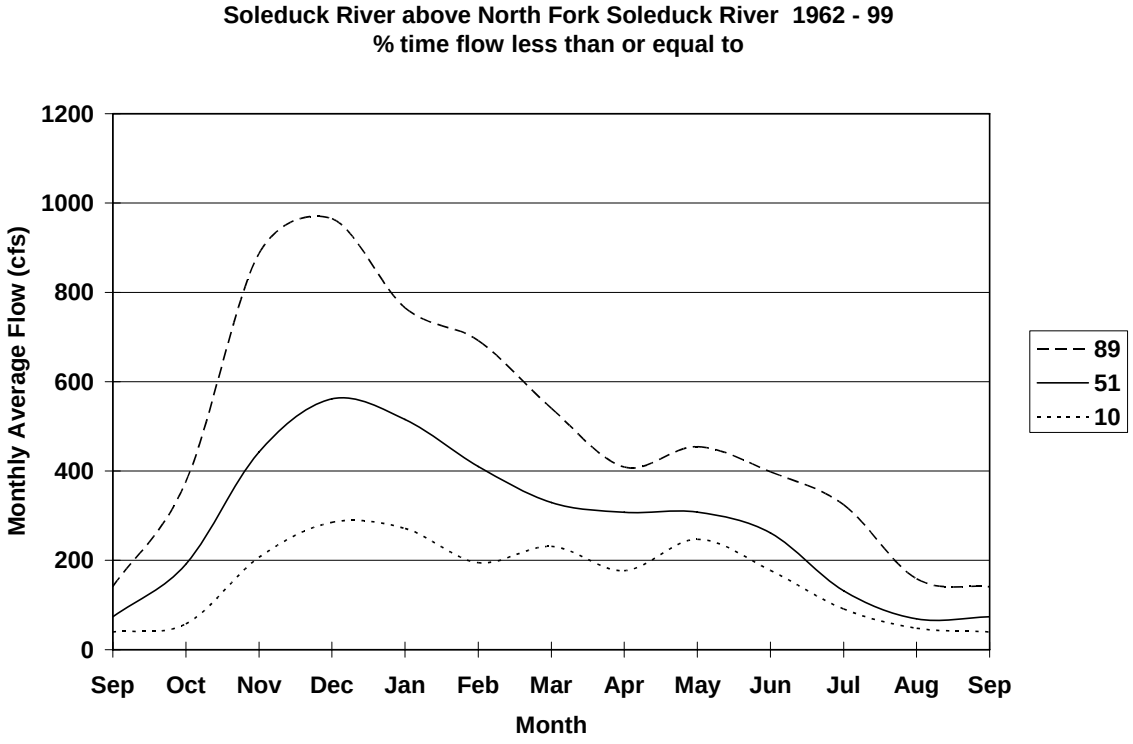

Table 38. The percent of time that average monthly streamflow (cfs) in the Soleduck River above the outlet of the North Fork Soleduck River is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	376	887	965	765	692	541	409	455	398	324	159	141
51	191	443	561	515	410	330	308	308	261	132	69	73
10	58	207	285	272	195	231	177	247	177	91	48	40

Soleduck River near Fairholm (at USGS gage 12041500) –

Streamflow at this discontinued USGS streamflow gaging station is the result of the three major upstream basins, specifically the North Fork Soleduck River, the Soleduck above the North Fork, and the South Fork Soleduck River drainage. The gage summary provided by the USGS provides a latitude and longitude for the gage of having been located at River Mile 54.5. The contributing drainage area at this point was measured as 83.8 square-miles, and the altitude of the gage is about 1060 ft, where precipitation averages over 97 inches annually. Regression equations against the Quinault River USGS gage were used to estimate streamflow during ungaged times, as previously discussed.

Similar to each upstream basin, the months indicated with the greatest variability in streamflow are November through January and baseflow streamflow levels typically end in September.

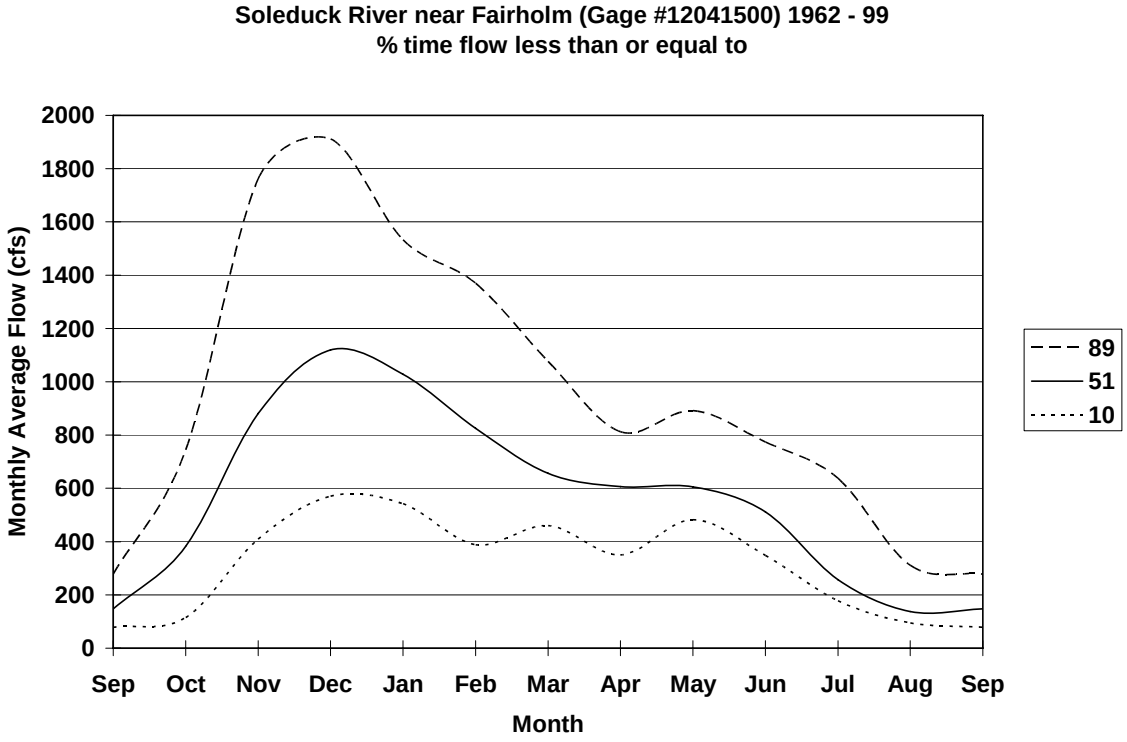

Table 39. The percent of time that average monthly streamflow (cfs) in the Soleduck River at the Fairholm gage is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	744	1761	1911	1533	1370	1077	812	892	773	638	311	278
51	383	881	1119	1028	825	656	606	606	512	257	138	148
10	115	410	571	542	388	460	350	483	348	177	95	79

Soleduck River near Beaver Creek (at USGS gage 12042000) –

The contributing area above this location measures 115.1 square-miles, and includes contributions from several tributaries, such as Goodman Creek and Camp Creek. Approximately 65 percent of this entire area is classified as highland subwatershed, and the remaining 35 percent is characterized by upland subwatershed. The watershed characteristics method was used to estimate streamflow at this location, since this gage only operated during the 1920's and no other Soleduck River gages were in operation at the time.

Flow in the Soleduck River is highest during the winter season precipitation maximum and recedes to minimum flow during the late summer and into the fall. This minimum flow season is indicated to extend occasionally into October, but more often ends in September. The months between November and January exhibit the greatest indicated variation in streamflow. The streamflow pattern is similar to that estimated at the USGS Fairholm gage, but the spring snowmelt runoff is less defined due to the increase of upland subwatersheds contributions.

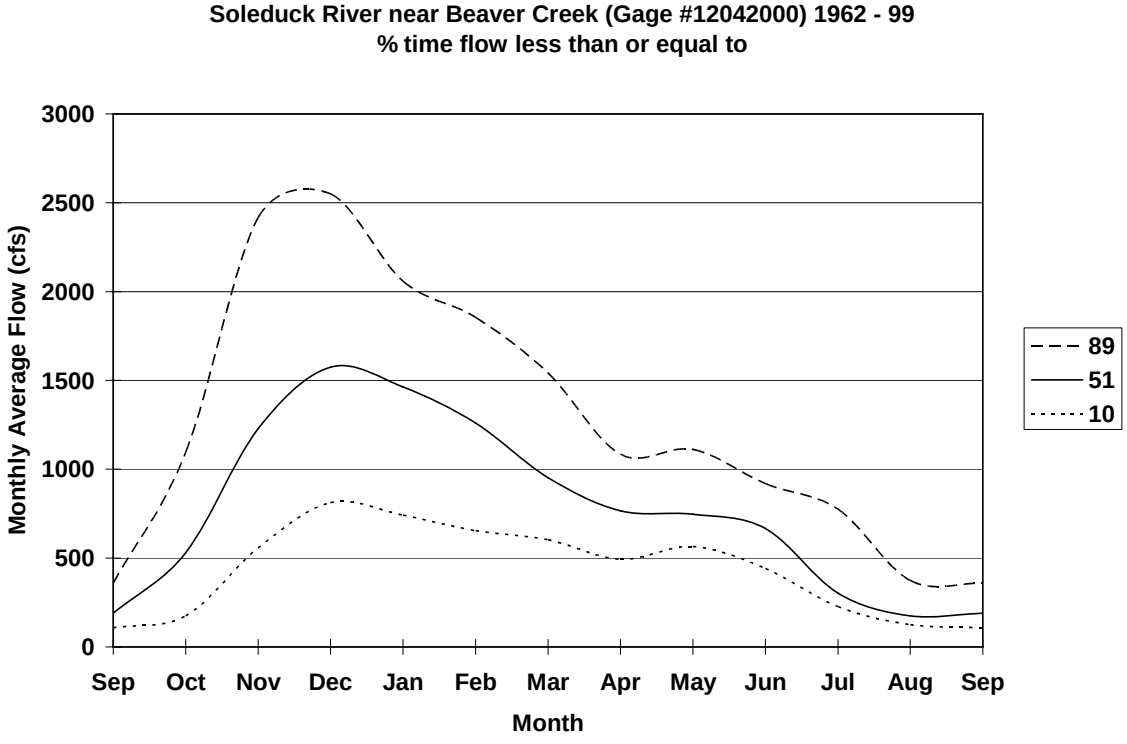

Table 40. The percent of time that average monthly streamflow (cfs) in the Soleduck River near Beaver Creek is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	1094	2417	2550	2058	1855	1542	1084	1112	918	776	373	358
51	530	1229	1575	1463	1260	953	766	747	666	302	174	189
10	174	557	812	742	654	603	493	565	441	227	125	108

Soleduck River below Lake Creek –

The Soleduck River continues to the west and south, and is fed by Kugel Creek, Bear Creek, Beaver Creek, and Lake Creek. Soleduck River streamflow at this point represents flow at RM 24.46. Precipitation varies from around 90 inches annually along the northern edge of the Bear Creek drainage to over 125 inches to the north of Lake Pleasant, which feeds Lake Creek. Streamflow at this location was estimated using the watershed characteristics method.

Flow in the Soleduck River below Lake Creek is highest during the winter season precipitation maximum and recedes to minimum flow during the late summer and into the fall. This minimum flow season is indicated to extend occasionally into October, but more often ends in September. The months between November and January exhibit the greatest indicated variation in streamflow.

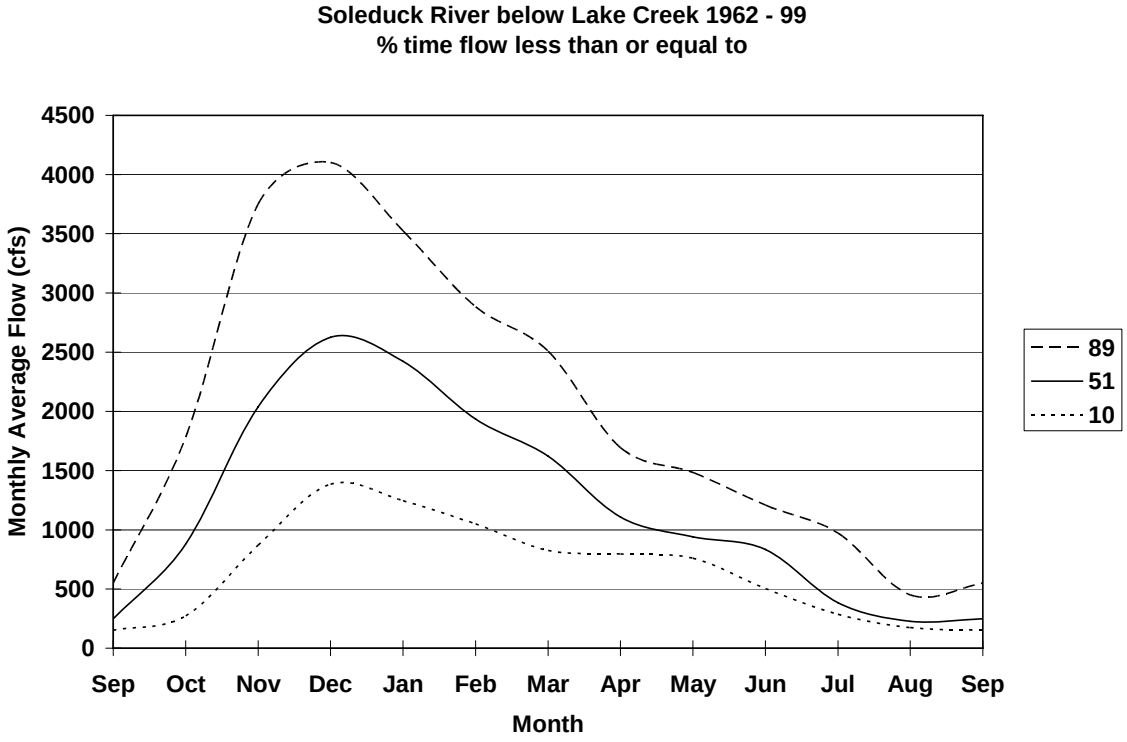

Table 41. The percent of time that average monthly streamflow (cfs) in the Soleduck River below Lake Creek is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	1781	3751	4101	3525	2884	2509	1693	1483	1207	972	450	549
51	881	2039	2625	2422	1934	1621	1108	941	834	385	227	248
10	272	869	1386	1245	1049	826	796	760	503	286	174	152

Soleduck River near Quillayute (at USGS gage 12042500) –

Another small tributary name Gunderson Creek outflows into the Soleduck River downstream of Tassel Creek and is the last named tributary before the discontinued USGS gaging station near Quillayute. This gage was located at RM 13.81, where the Quillayute Road crosses the Soleduck River. The contributing drainage area above this location measures 216.6 square-miles. Precipitation ranges from 95 inches annually north of the gage up to over 123 inches annually along the Calawah Ridge.

Gaged streamflow information for the USGS gage 12042500 near Quillayute during the pertinent period of record between October 1961 and September 1999 was readily available between October 1977 and September 1980. To estimate the gains in streamflow that occurred between the Soleduck River gage near Fairholm and the gage near Quillayute, the Fairholm gaged data for this time period was subtracted from the Quillayute gaged data. These resultant change data were regressed back to the Fairholm gage as well as other nearby streamflow gages in the Calawah and Dickey River watersheds to estimate a complete period of record for the gains that occurred between the two Soleduck gage sites. After application of regression equations against the Calawah and Dickey River USGS gages, 14 percent of the period of record (64 months) had not been estimated due to a lack of sufficient gaged data. These remaining months were estimated from the extended synthetic Calawah River streamflow record. As a result, these remaining 64 months were created from data that originated from:

- Bogachiel River gaged streamflow data (6 values, April – Sept 1975)
- Hoko River gaged streamflow data (15 values, Oct 1973 - Sept 1974 and Aug - Oct 1983)
- Hoko River synthetic data made from precipitation data from Sappho, Clallam Bay, Forks, and Neah Bay (43 values)

This complete record of estimated gains was added to the extended Fairholm gage record to create an extended synthetic period of record for the Soleduck River at the Quillayute gage site between October 1961 and September 1999.

Calibration of these streamflow estimates for the Quillayute gage location was enabled by the discovery of several instantaneous streamflow measurements collected by the USGS at the gage location between November 1975 and August 1977. These instantaneous measurements provided anchor points in the streamflow hydrograph that were used to rescale the streamflow variation (or average daily streamflow values) exhibited at the Soleduck near Fairholm gage. This process of rescaling the Soleduck River gage near Fairholm produced an estimated daily hydrograph for the Quillayute gage location. These average daily values were summarized into total monthly streamflow in ac-ft, and then the total monthly streamflow values were compared to the estimated monthly streamflow value generated by adding the estimated gains between the two gages to the extended record for the Fairholm gage. This calibration provided uniquely beneficial information, since the data provided a relatively good estimate of

monthly total flow. For example, this calibration illustrated that gain values developed from other low elevation streamflow gages, such as the Dickey River and Calawah River USGS gages, provided better estimates of gains between the two Soleduck River gages than gain values deriven directly from the Soleduck River gage near Fairholm. High flow months were especially poorly developed from the Fairholm gage, as the values developed were extremely too large and provided estimates of streamflow at the Soleduck River gage near Quillayute that were unrealistically large. As a result of these findings, gain values developed using the Soleduck gage near Fairholm were used sparingly and only for months when the Calawah and Dickey River gage were not in operation.

Streamflow at this location is dominated by the winter season precipitation maximum, as illustrated throughout the Soleduck River. The snowmelt runoff during spring months does not exhibit a dramatic increase in streamflow on a monthly basis, unlike upstream areas. Streamflow levels recede to minimum flow in the late summer and extend most often in to September.

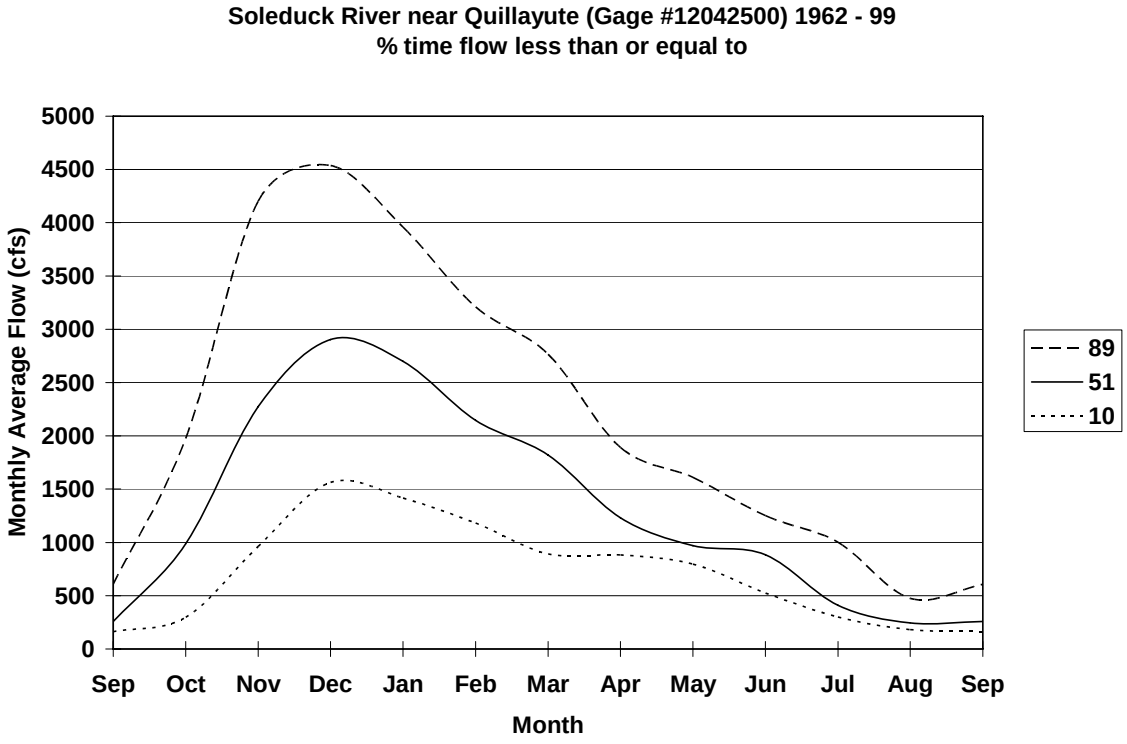

Table 42. The percent of time that average monthly streamflow (cfs) in the Soleduck River near Quillayute is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	1976	4202	4537	3959	3211	2766	1891	1610	1249	1002	474	607
51	987	2274	2904	2699	2146	1820	1230	970	884	410	244	258
10	297	962	1564	1416	1181	893	883	796	525	300	183	162

Soleduck River at the Outlet –

As discussed previously, the Soleduck River outflows into the Bogachiel River to mark the beginning of the Quillayute River. Numerous historical instantaneous streamflow measurements were used to determine the change in streamflow in the Soleduck River the USGS gaging station 12042500 near Quillayute and the outlet. Specifically, 49 instantaneous streamflow measurements were collected at the mouth of the Soleduck River between September 20, 1977 and September 29, 1978. The Soleduck River gage near Quillayute was in operation during 46 of these measurements, beginning on October 1, 1977. The increase in Soleduck River streamflow between the gaging station near Quillayute and the outlet is considered to be negligible in most months, with the majority of months exhibiting a slight decrease in total monthly streamflow. This result can be explained by the characteristics of the last few downstream miles of the Soleduck Valley, which are wide and flat. The majority of precipitation that falls in this area does not directly contribute to streamflow due to interception and losses to evaporation or subsurface flow.

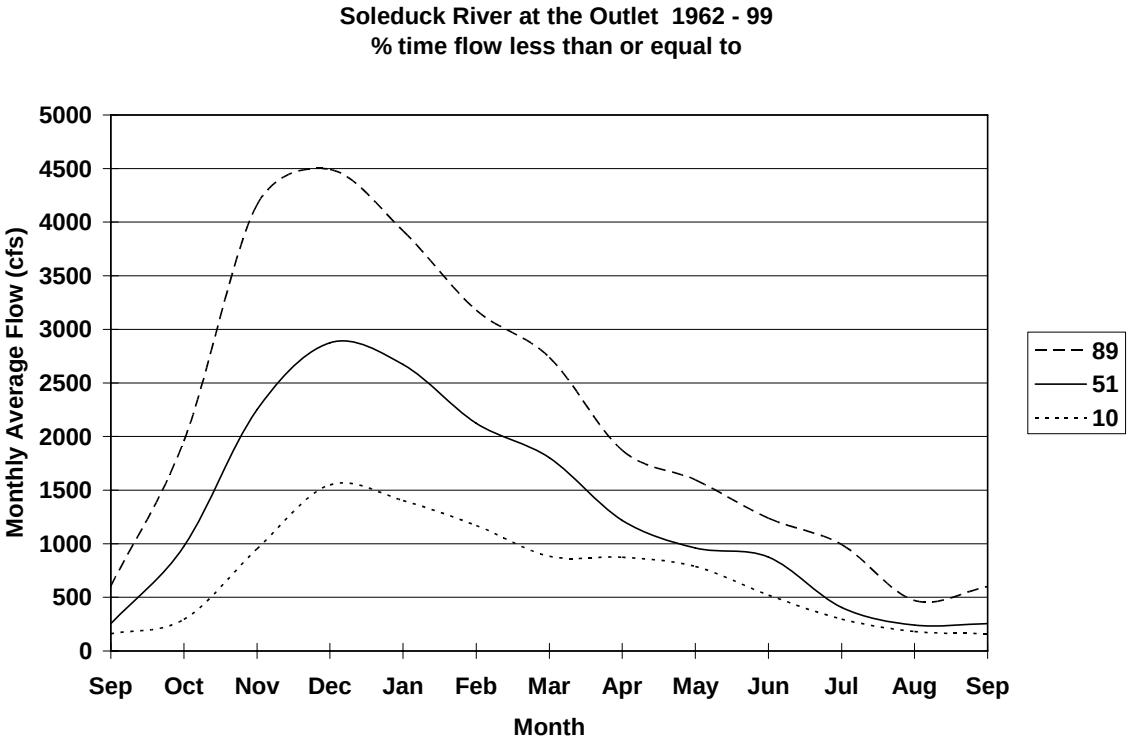

Table 43. The percent of time that average monthly streamflow (cfs) in the Soleduck River at the outlet is less than or equal to the indicated value.

Percent	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
89	1956	4160	4492	3919	3179	2739	1872	1594	1237	992	469	601
51	977	2251	2875	2672	2125	1802	1218	961	875	405	242	256
10	294	953	1549	1402	1169	884	874	788	519	297	181	160

Dickey River watershed –

The Dickey River watershed is the last major contributing area to the Quillayute River before it outflows into the Pacific Ocean. As illustrated in Figure 23 below, the Ozette River watershed is located to the west of the Dickey River watershed, while the Soleduck River is located to the east. Dickey River is fed by two main tributaries, the East Fork and West Fork Dickey Rivers. The direction of flow is in the southwestern direction before outflowing into the Quillayute River at RM 1.2.

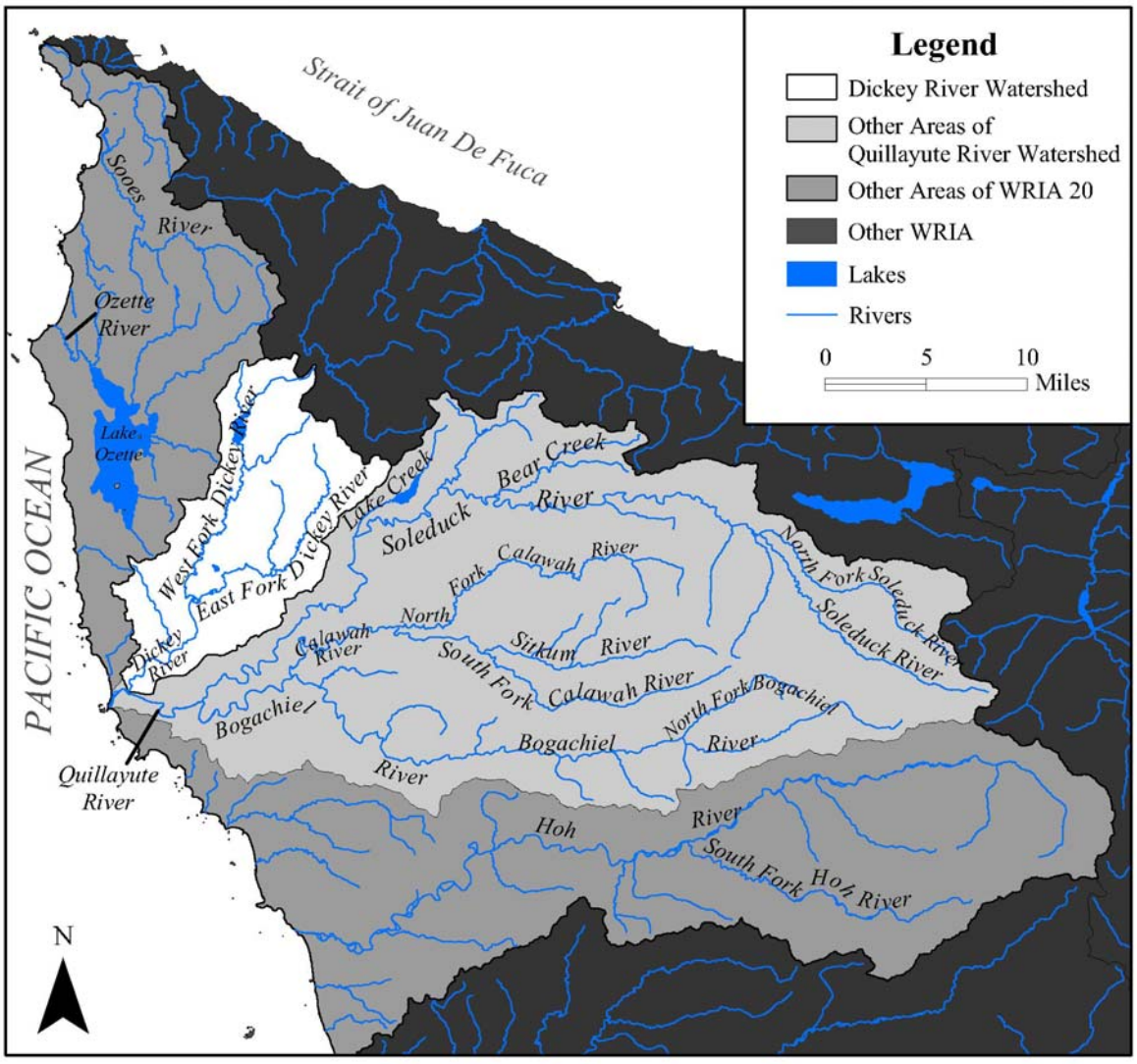

Figure 23. Location of Dickey River watershed within WRIA 20

The Dickey River watershed measures over 107 square-miles in area, of which the majority is private owned. The remaining areas are administered either by the